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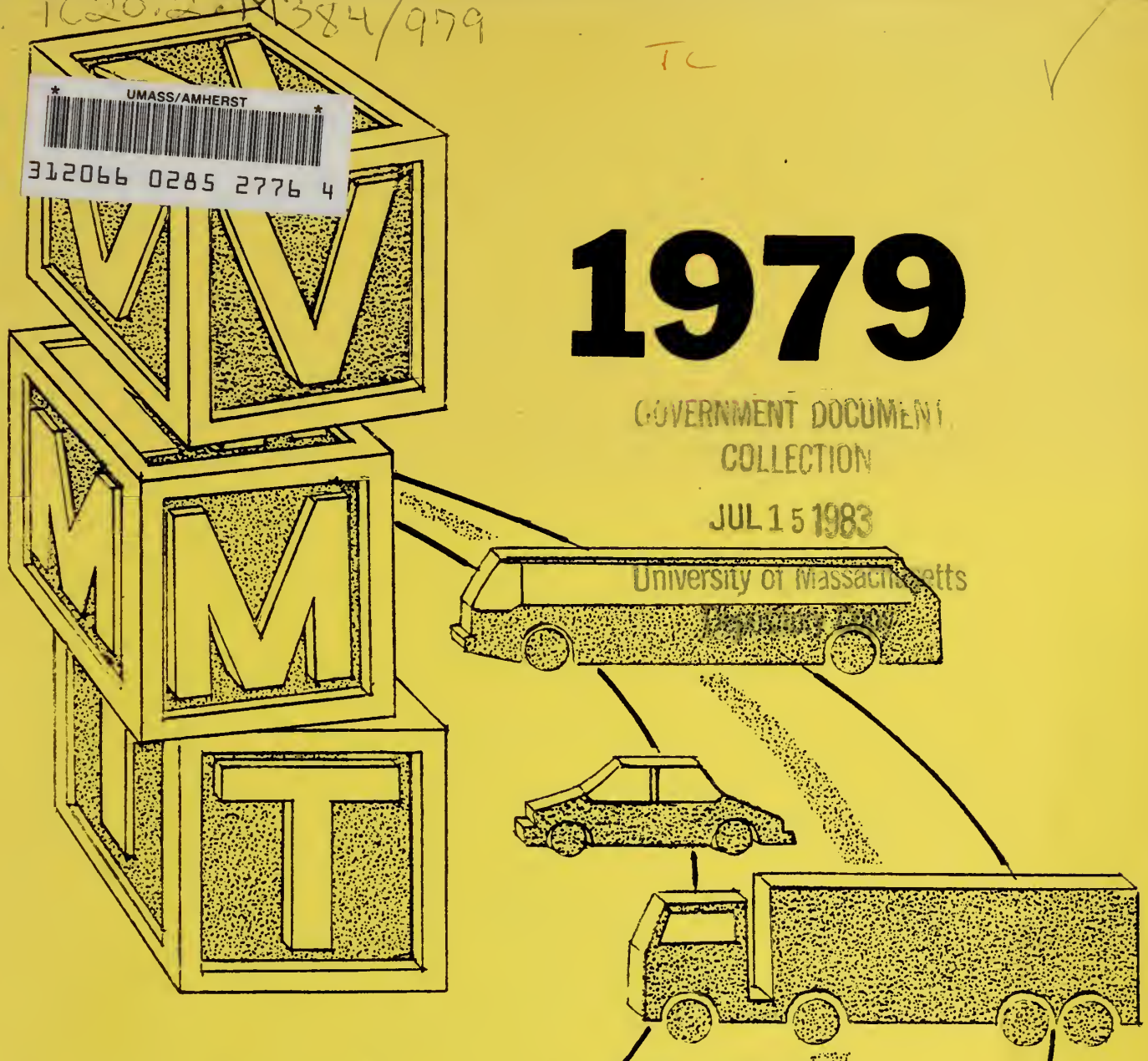

# 1979

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# Vehicle Miles of Travel Analysis

MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS
Bureau of Transportation Planning & Development

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U.S DEPT OF TRANSPORTATION

# MASSACHUSETTS

# 1979

# VEHICLE MILES OF TRAVEL

# (VMT)

# ANALYSIS

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October, 1980

Massachusetts Department of Public Works
Bureau of Transportation Planning and Development

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## Introduction

The following report published by the Bureau of Transportation Planning and Development describes the analysis used in the preparation of the total estimated 1979 annual vehicle miles of travel (AVMT) for the Massachusetts road network.

The development of statistically reliable estimates of vehicle miles of travel is an important factor in measuring the impact of such programs as Governor King's 10 point plan for gasoline/energy conservation, car and vanpool programs, and transportation systems management plans geared for increased use of mass transit.

Since this analysis also includes a review and evaluation of fuel consumption trends, it provides a necessary input for future state energy policies.

On a more local basis these travel estimates are used as indicators of areas requiring special attention such as the need for development of new park and ride sites or increased community based or employer based ridesharing through the Bureau's Masspool program.

It is vital that the Commonwealth maintain estimates of AVMT data not only to satisfy federal reporting requirements but also to share with other State agency users such as the Office of Energy Resources, the Department of Environmental Quality Engineering and the Insurance Commission.

The official estimate for the state AVMT in 1979 is 35.178 billion. The analysis which derived this estimate is supported by evaluations of motor fuel consumption, vehicle registration, trends in fuel efficiency, traffic counting, transit ridership

and ridesharing information.

The 35.178 billion estimated AVMT for 1979 represents a +0.36% increase over the 1978 estimate which is the lowest rate of increase experienced in recent years.

This indicates that the State Administration's programs are moving us in the right direction, a direction of decreased fuel consumption with the accompanying decrease in air pollutants.

The conclusions of our AVMT endeavor and the methods of derivation are included in the following report.

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# 1979 AVMT Analysis

## I - Background

The Highway Performance and Analysis Division of the Bureau of Transportation Planning and Development (BTP&D), Massachusetts Department of Public Works (MDPW), prepares an annual estimate of the total vehicle miles of travel (VMT) driven on the roadways of Massachusetts during the preceding year. The resulting VMT estimates are incorporated in Departmental and other agencies work efforts such as the Department of Environmental Quality Engineering's air quality analyses, the Bureau of Traffic Operations' annual 55 MPH speed monitoring program, the FHWA's fatality rate Incentive Grant Program, and the FHWA's annual apportionment of Interstate '3R' funds to Massachusetts.

Travel data is a basic planning tool, essential for identifying current needs and forecasting future needs for the planning, design and maintenance of transportation facilities. It provides an indication of growth trends and aids in the functional classification of highways.

This report explains the methods used in the development of the VMT figures and how to best use these figures.

The 1979 AVMT development procedures require the following basic data: the length of each individual road and street segment together with the average number of vehicles travelling on that segment daily (AADT). The mileage multiplied by the AADT results in daily vehicle miles of travel (DVMT). The DVMT for all road and street segments are summed and then multiplied by 365 to arrive at AVMT.

There are several approaches which could have been utilized in developing the 1979 VMT figures. Some of these are:

A. The previous year's VMT figures could have served as a base and been increased or decreased based upon the growth or decline in motor fuel consumption.

B. Another approach could have utilized the previous year's VMT as a base and then examined the developing trends in fuel economy (MPG) in relation to the makeup, composition and age of the vehicle fleet.

C. Another approach could have again utilized the previous year's VMT as a base and then adjust according to current travel trends (percentage factors) derived from the previous year's Traffic Counting Program.

All of these methods are commonly used with variations by the various States in complying with their required AVMT reporting. The problem that arises with these approaches is that they all utilize a "floor" estimate as a base from which to build the next year's estimate of VMT. If the base figure is inconsistent (either high or low), then the next year's figure is also high or low, assuming that the current year's fuel consumption has also been estimated accurately.

In response to concerns regarding these approaches, the Massachusetts staff chose a different approach by estimating total annual VMT for the years 1977, 1978 and 1979 by combining two of the BTP&D's main data files, those of the Road Inventory and the Traffic Counting programs, with supplemental data analysis utilizing Motor Vehicle Statistics Section records.

The supplemental data included various driver and vehicle statistics. The combination of the two main files with the supplemental data resulted in the calculation of a combined total VMT estimate for each of the three years.

The effort of the three major work programs of the BTP&D's Highway Performance and Analysis Division helped to develop this VMT analysis:

A. Road Inventory Program

The BTP&D's Inventory and Statistics Unit maintains a continuously updated comprehensive road inventory data file which is used to service a variety of transportation activities. The data file contains administrative, geometric and physical condition data on the 33,620 miles of roads and streets existing in Massachusetts as of December 31, 1979. These lineal miles of roadway can all be driven using passenger vehicles. This information is contained on approximately 140,000 records in the road inventory data file. Several computer programs have been developed by the MDPW to display the data in varied formats.

The Administrative data in the file is of particular importance to this VMT analysis work effort, since each road segment is individually coded according to its functional classification (see glossary) and Federal-Aid (F.A.) system. These F.A. codes include the Interstate (FAI), Primary (FAP), Secondary (FAS), Urban (FAU), and the non-Federal-Aid Systems. For all segments on a particular Federal-Aid system, a Federal-Aid identification number is also coded. Also included on each FAI, FAP, and FAS route is a so-called 'NHIPS' ordering number, which allows the print out of the data file on a continuous beginning to ending route basis.

Thus, it is possible to determine the FA status of each link in the data file, as well as to allow for the print out of the data not only by FA system but by individual FA route number as well.

B. Traffic Counting Program

The Traffic Counting Program conducted by the BTP&D provides traffic volume data through a cooperative arrangement between the BTP&D and the Department's District Office crews.

The traffic counting program is Statewide in scope. Data is collected by means of mechanical automatic traffic recorders (ATR's) at four different types of stations/locations. They are:

1 - Continuous Count (26 stations statewide)

Traffic volume counts are taken each hour of the day, 365 days each year, year after year.

2 - Control Count (112 stations statewide)

Traffic volume counts are taken every hour for two weeks each month, 12 months each year, year after year.

3 - Coverage Counts (650 stations statewide in 1979)

Traffic volume counts are taken once yearly for a 48-hour duration.

4 - Special Counts (440 locations statewide in 1979)

Traffic volume counts are taken one time only for special projects, for a 24 to 48 hour duration.

In addition, other traffic counts are taken by the cities and towns and where possible incorporated into the traffic counting records. Technical analyses of the traffic count data, as well as overall coordination of the program, are the responsibility of the BTP&D's Travel Data & Forecasting Section.

C. Motor Vehicle Statistics Program

The Motor Vehicle Statistics Section collects and maintains basic data files on motor-vehicle registrations, motor-fuel consumption and driver licenses, as well as completes required reports on finances, and tax derived revenue. This information is used in a variety of programs, with the data being primarily used by the Federal Highway Administration in their annual report, entitled "Highway Statistics." Data sources include the financial records of the cities and towns, the State offices of the Registry of Motor Vehicles and the Department of Revenue.

II - 1979 VMT Development Procedures

The procedure adopted for developing the 1979 AVMT figures took into account the fact that the continuous and control stations are situated for the most part on roadways of the highest functional classifications. Table 1 (see page 7 ) summarizes the distribution of the continuous and control stations stratified by both functional classification and Federal-Aid system.

As indicated by the figures, of the 138 continuous and control stations in Massachusetts, 22 are on the Interstate system, 85 are on the combined "Principal" arterial and "Minor" arterial system, which together make up the balance of the F.A. Primary system. Of the 31 stations remaining, 7 are on the urban "Other Principal" arterial system and 9 are on the urban "Minor" arterial system, resulting in a total of 16 on the FA Urban system. The remaining 15 are on the rural "Major Collector" system, which makes up the FA Secondary system.

There are several reasons for this heavy concentration of continuous and control stations on the higher Federal-Aid systems (Interstate, Primary and Secondary). While historical location does play a large part, the establishment of long term trends is a major requirement for successful factoring of 24 hour and 48 hour coverage and special traffic counts to an AADT volume. This is a necessary activity for the successful development and support of the MDPW's highway program. These high travel corridors being monitored move the people, goods and services so necessary to the Commonwealth's social and economic systems.

Although the continuous and control stations provide valuable data which is used in a variety of ways for many

TABLE I

CONTINUOUS & CONTROL STATION DISTRIBUTION

(1979)

| FUNCTIONAL CLASSIFICATION SYSTEM | RURAL | URBAN | TOTAL | FEDERAL - AID SYSTEM | | | |
|---|---|---|---|---|---|---|---|
| | | | | INT. | PRIMARY | SECONDARY | URBAN |
| 1 - Interstate | 4 | 18 | 22 | 22 | N/A | N/A | N/A |
| 2 - Principal Arterial & Urban Extension | 12 | 33 | 45 | N/A | 45 | N/A | N/A |
| 3 - Minor Arterial & Urban Extension | 18 | 22 | 40 | N/A | 40 | N/A | N/A |
| 4 - Other Principal Arterial | N/A | 7 | 7 | N/A | N/A | N/A | 7 |
| 5 - Rural Major Collector/Urban Minor Arterial | 15 | 9 | 24 | N/A | N/A | 15 | 9 |
| 6 - Rural Minor Collector/Urban Collector | 0 | 0 | 0 | N/A | N/A | N/A | N/A |
| TOTAL | 49 | 89 | 138 | 22 | 85 | 15 | 16 |

N/A = Not applicable

purposes, these 138 stations cannot provide all of the data necessary for VMT analysis.

The 1090 coverage and special traffic counts taken in 1979 provided most of the traffic flow data used in the VMT estimation. The 650 coverage counts were placed at the same locations as in previous years, though the actual counts were taken at different times throughout the year.

Each raw count was factored using continuous and control stations located in similar geographic areas to arrive at comparable AADT values. The coverage counts are located for the most part on the numbered auto route system and provide a great deal of traffic volume data for VMT analysis.

The 440 "special" counts taken in 1979 were requested by the Department's Highway Design Section, as well as other sections within the Department. These were primarily for specific projects to measure present traffic flow and associated characteristics, and to determine future travel demand estimates at these specific project sites. They were one-time-only counts and less useful for VMT analysis work.

The results of the traffic counting program are contained in the BTP&D's publication "Traffic Volumes' Massachusetts 1979." Each continuous, control, coverage and special count taken in 1979 is listed in this publication, along with its auto route number and/or its specific street name location.

A - Federal-Aid Primary System Analysis

The maps used for VMT analysis are at a scale of 1" = 1 mile and cover the State on a regional basis. Each map was color coded for the Federal-aid Interstate, Primary and Secondary system and by F.A. urban boundaries. Also shown are the F.A.

route numbers including the individual "NHIPS" section numbers as described in Chapter I. As previously indicated, the NHIPS numbers allow the ordering of the road inventory data file output on a continuous route basis from beginning to end. These numbers are coded on each FAI, FAP and FAS route in the road inventory data file.

The 1979 Traffic Volume book was the source document for the AADT's used for the FA Interstate and Primary systems in 1979. Each traffic count listed in the book which was located on either the FAI or FAP systems and was plotted on an acetate overlay over the proper locations on the 1" = 1 mile regional map. This work effort continued until all existing 1979 counts were plotted. The actual traffic counts for the years 1976, 1977 and 1978 as measured by the Department and previously plotted have been retained on these maps for VMT analysis work. Also included on the base map are the 1975 AADT estimates used in completing the National Highway Inventory and Performance Study (NHIPS) in 1976.

Many of the FAI and FAP Routes were covered by the 1979 counts. Where gaps existed in the 1979 year data, it was necessary to estimate the missing values. This was accomplished by estimating the volume on the uncounted link by using the 1979 volumes on the adjoining sections as well as the previous year's historical values plotted on the maps. This procedure allows a missing value to be "plugged" by enabling the analyst to picture a reasonable traffic flow. The end result of this work effort was either an actual or estimated 1979 AADT for each link of the Federal-Aid Interstate and Primary systems, on a route number and section specific basis.

It was necessary to enter these volumes in the road inventory data file. The mechanism to do this is the existing National Highway Inventory & Performance System (NHIPS) data file. Each FAI and FAP Route segment was coded with the estimated 1979 AADT and inserted into a copy of the NHIPS data file, and from there transferred into the road inventory data file. Existing road inventory computer programs were then run which summarized the resulting FAI and FAP VMT by county by functional classification.

B. Federal-aid Secondary and non Federal-aid System Analysis

A limited amount of data existed on AADT's for the lower arterial and collector functional classifications. These included rural "Major" and "Minor" collectors, as well as urban "Other Principal" and "Minor" arterials, and "Collectors". The next procedure was to sum up the 1979 VMT on the top 3 functional classifications (which make up the FAI and FAP systems) by urban and rural separately, and compare that figure with a similar summary from the 1977 and 1978 VMT data. The resulting figures are shown in Table 2. (See page 11).

The 47.27% of the total 1978 VMT for the three urban functional classifications was very similar to the 46.55% of the total 1977 VMT for these same systems. The equivalent rural percentage was also similar from 1977 to 1978. It was thus decided as a first try at a preliminary 1979 VMT figures to keep this figure constant for 1979. This resulted in the following calculations for preliminary total State 1979 DVMT.

Table 2

1977 DVMT

| | Urban | Rural |
|---|---|---|
| Interstate | 15,112,770 | 3,517,385 |
| Principal Arterials & Urban Extensions | 11,876,124 | 2,652,977 |
| Minor Arterials & Urban Extensions | 7,936,234 | 4,192,936 |
| Subtotal | 34,925,128 | 10,363,298 |
| Total All Systems | 75,028,876 | 17,516,422 |
| Subtotal/Total All System = | 46.55% | = 59.16% |

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1978 DVMT

| | Urban | Rural |
|---|---|---|
| Interstate | 15,989,311 | 3,710,883 |
| Principal Arterials & Urban Extensions | 13,144,183 | 2,969,600 |
| Minor Arterials & Urban Extensions | 7,638,981 | 4,136,700 |
| Subtotal | 36,772,475 | 10,817,183 |
| Total All Systems | 77,793,561 | 18,239,991 |
| Subtotal/Total All Systems = | 47.27% | = 59.30% |

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1979 DVMT

| | Urban | Rural |
|---|---|---|
| Interstate | 16,385,800 | 3,631,100 |
| Principal Arterials & Urban Extensions | 13,037,800 | 2,812,400 |
| Minor Arterials & Urban Extensions | 7,656,400 | 4,308,400 |
| Subtotal | 37,080,000 | 10,751,900 |

URBAN

$$\frac{\text{1978 DVMT}}{}$$

$$\frac{36,772,475}{77,793,561} = 0.4727$$

$$X = \frac{37,080,000}{0.4727} = 78,442,987 \text{ total State 1979 urban DVMT}$$

RURAL

$$\frac{\text{1978}}{}$$

$$\frac{10,817,183}{18,239,991} = 0.5930$$

$$Y = \frac{10,751,900}{0.5930} = 18,131,365 \text{ total State 1979 rural DVMT}$$

Summary

| | | |
|---|---|---|
| Urban | 78,442,987 | DVMT |
| Rural | 18,131,365 | DVMT |
| Total | 96,574,352 | DVMT |

The % increase 1979 over 1978 using this figure would thus be 96,574,352/96,033,552 = +0.56%. It had initially been thought that the % change in VMT 1979/1978 should be in the ± 1-2% category, so this figure was considered acceptable for preliminary trial purposes.

Each county's VMT figure by urban/rural for the "Interstate", "Principal" and "Minor" arterial systems, as well as their urban extensions were then entered on a summary tabulation sheet alongside the same equivalent figure for 1978. The 1978 VMT figures for the lower functional classifications were entered, with the 1979 figures at this point in the analysis undetermined. These remaining functional classifications included the urban "Other

Principal" Arterial (U4), "Minor" Arterial (U5) and "Collector" (U6), as well as the rural "Major" collectors (R5), and the "Minor" collectors (R6), and for the "Local" road systems UO and RO.

The urban "Other Principal" arterial system (U4) was handled next. The following relationship was developed:

$$\frac{\text{1978: U4 VMT TOTAL STATE}}{\text{1978: All FC Urban VMT Total State}} = \frac{\text{1979: U4 VMT TOTAL STATE}}{\text{1979: All FC Urban VMT Total State}}$$

In essence, the relationship between the U4 functional classification VMT as a percentage of the total State urban VMT all systems was held from 1978 to 1979. The result was 1979 preliminary VMT on the total State U4 system. To allocate this VMT by county, the following relationship was used with the U4 VMT, Individual county (1979) being the missing value:

$$\frac{\text{1978: U4 VMT INDIVIDUAL COUNTY}}{\text{1978: U4 VMT Total State}} = \frac{\text{1979: U4 VMT INDIVIDUAL COUNTY}}{\text{1979: U4 VMT Total State}}$$

Using this relationship each county's individual U4 VMT was then calculated on a preliminary basis. Each total county U4 VMT was then divided by the total county mileage on that system, and the resulting average AADT, rounded to hundreds, was inserted into the road inventory data file on each link of that system in that particular county.

This process was continued with the remaining arterial and collector categories. A slight exception is that one additional

step was carried out with the rural "Major Collector" (R5) system since this is the FA secondary system. In 1978 an extensive VMT analysis was conducted on the FA secondary system similar to the section by section analysis completed this year for the Interstate and Primary systems. As a result, the 1978 AADT's on the R5 system were route and section specific, and not just a total county estimated average AADT.

Therefore, once the individual county totals for the R5 system were determined from the steps above, each specific link making up that system was adjusted using the following relationship:

$$\frac{\text{R5 VMT - Individual County (1979)}}{\text{R5 VMT - Individual County (1978)}}$$

Rather than use one uniform AADT value for each county, each individual route and segment link 1978 AADT was multiplied by this factor, thus ensuring that the individual link by link relationship which existed in 1978 was preserved into 1979.

Another additional step was also carried out in the cities of Springfield and Chicopee in Hampden County. In the Department's District 2 office, the District Planning Engineer worked directly with the City Engineers to develop specific AADT's on each arterial and collector link. These AADT's were individually coded upon the completion of the previously described work effort and inserted into the road inventory data file. The resulting VMT figures for these two communities should therefore be at a higher level of accuracy than for the rest of the State's communities.

The only functional classification system remaining without AADT's was now the FA urban and rural "local" system.

One of the coding restrictions in using the road inventory data file is that AADT traffic volumes must be entered in units of hundreds. An AADT of 7070 for example, cannot be coded as such in the file. The number which would be coded would be 71, representing 7100. This does not present a problem with the arterial and collector systems, since there is normally an allowable variation in the exact volume as mechanically measured, due to machine variation, the number of lanes, extent of traffic volume, extreme weather conditions, etc.

Where this coding restriction does present a problem, however, is on the local road system due to the lower magnitude of the AADT figures. This was handled by estimating the total local road contribution to total State VMT, both for the F.A. urban and rural areas separately, and for the total local roads system as a whole. To arrive at these figures it was necessary to assign an AADT to each county's functional classification local road mileage separately. In previous years this was accomplished by examining each county's arterial and collector AADT relationship and relating that to the average volume for that particular functional classification for the State. The assigned AADT's for the local road system were then assumed to be related to the State's average AADT for the local system, in a manner similar to that of each county's arterial and collector AADT to the State average AADT for each particular functional classification.

The assigned AADT's in the urban areas in 1978 ranged from 200 to 600, while the rural local AADT's ranged from 100 to 200. Since the total local roads mileage increased only slightly from 1978 to 1979 (1.07 miles) the average estimated AADT for a parti-

cular county would have to change significantly before it would be necessary to change the assigned AADT figure. In the case of an AADT volume of 200, the change would have to be ± 25%, while with 600 AADT it would have to be ± 8 1/3%.

It is reasonable to assume that the local road system does not change significantly in overall average AADT from year to year. This is due in large part to the character of vehicle traffic served by this system and that local roads are reclassified upon the request of local officials within the cities and towns when the character and use of the road changes. Local roads provide direct access to abutting land as well as serving as a conduit for local land use to the collector and then the arterial road systems. It was therefore decided that the 1978 AADT's assigned to each county by urban/rural would remain constant in 1979.

At this point in the analysis every section of road in the 1979 road inventory data file was assigned a preliminary AADT. The AADT on each link when multiplied by the length of each link, resulted in a preliminary figure of 96,377, 549 DVMT, or 35.178 billion AVMT.

This figure represents a +.36% increase from 1978 to 1979, which is slightly lower than the initial analysis indicated.

The next task was to evaluate this figure based upon existing 1979 statistical data, such as fuel consumption, vehicle registrations, driver licenses, and the increasing efficiency of the motor vehicle fleet.

## III - Correlation of VMT results with Motor Vehicle Statistics

A standard procedure in VMT evaluation and analysis work is to relate data and ratios resulting from a preliminary VMT estimate. One of the most useful related statistics is the number of gallons of motor fuel consumed for highway purposes. This information is updated regularly by the Massachusetts Department of Revenue, Bureau of Sales and Excise. An accurate accounting of fuel consumption is maintained, since highway use of motor fuel is taxed by the State of Massachusetts with the proceeds in 1979 being apportioned between the Massachusetts Transportation Fund and the Massachusetts Highway Fund. The total number of gallons of motor fuel used in Massachusetts in calendar year 1979 was 2,581,601,335 gallons.

This initial figure was then adjusted using an analysis procedure originally developed by the Federal Highway Administration and referred to as "Analysis of Motor Fuel Usage". This procedure starts with the total motor fuel usage figure mentioned above, and corrects it for refunds, such as for marine and farm use. The final adjusted figure for highway usage of motor fuel in 1979 was 2,538,758,000 gallons, and includes use by both public and private vehicles. This is the offical highway use figure which will appear in tables MF-21 and MF-23 of the Federal Highway Administration's 1979 edition of their annual publication "Highway Statistics". Since the comparable figure for 1978 was 2,587,521,000 gallons, the 1979 figure indicated a reduction of 1.9% for 1979 over 1978 in motor fuel consumption for highway purposes.

This decrease was caused by many factors, including the enforcement of the National 55 MPH speed limit, the growth in the popularity of carpooling, increases in the price of motor fuel, and the combining of miscellaneous vehicle trips. The major factor, however, was the continued development and sale of the newer fuel efficient automobiles. As these automobiles made an increasing impact on the Massachusetts automobile fleet, older less fuel efficient vehicles were being scrapped.

The Massachusetts Registry of Motor Vehicles registers all motor vehicles owned and used for highway purposes. Data reported by the RMV for 1979 indicates a total registration of 3,814,644 motor vehicles, which is a +2.7 percent increase over 1978. Passenger cars account for more than 85% of all vehicles in the state whereas the national percentage of passenger cars is approximately 75%. This difference is significant in that the miles per gallon for the Massachusetts vehicle fleet is well above the National average. The following factors demonstrate that passenger cars in the state are achieving increasingly greater miles per gallon each year:

1. The Energy Policy and Conservation Act (EPCA) passed by the Congress in 1975 required that all 1978 and 1979 passenger vehicles (U.S. manufactured and imported) achieve at least 18 and 19 miles per gallon respectively. As of July 1979, 15.2% of all passenger cars in Massachusetts were either 1978 or 1979 vehicles.

2. The percentage of more fuel efficient imported cars in the auto fleet has increased substantially each year. These imports made up over 17% of all passenger car registrations in

Massachusetts in 1979. Based on data provided by the R.L. Polk Co., the following growth rates indicate this recent trend. In the year 1978 the number of imported cars increased 6.2% over 1977, while at the same time the balance of the passenger car fleet increased by 3.9%. In 1979 the number of imports increased 7.6%, while all other passenger cars increased by only 2.6%.

3. The number of small cars in the Massachusetts auto fleet increased in 1979 while the number of larger less fuel efficient vehicles decreased. Based on RMV tapes listing automobiles by cylinder for 1978 and 1979, the number of four cylinder automobiles increased 3.7% in 1979 and five and six cylinder autos increased by 4.4%, while during the same time period automobiles with eight or more cylinders decreased by 1.8%.

The ratio of vehicle miles of travel divided by motor fuel consumption for highway use results in miles per gallon. This statistic is valuable in comparing with past trends and in developing estimates of the future using the mandates of the Energy Policy and Conservation Act.

The MPG figures for the past five years reported by Massachusetts in its annual TA-1 table are shown below:

| YEAR | REPORTED MPG | ACTUAL GROWTH RATE | 1974-1978 AVERAGE ANNUAL COMPOUND GROWTH RATE |
|---|---|---|---|
| 1974 | 12.92 | -- | -- |
| 1975 | 13.03 | + .85 | 1.2 |
| 1976 | 13.08 | + .38 | 1.2 |
| 1977 | 13.25 | +1.30 | 1.2 |
| 1978 | 13.54 | +2.19 | 1.2 |

Several different alternative scenarios were developed for estimating the 1979 MPG figure.

Alternate 1

An average annual rate of growth from 1974 to 1978 was calculated as +1.2%. This provides a very conservative approach, and it is felt that this rate of increase is the minimum that could have occurred. This rate results in a figure of 13.54 x 1.012 = 13.70 MPG.

Alternate 2

The +2.19% rate of growth from 1977 to 1978 was considered next. The continuation of this growth rate into 1979 depends on the continuing production of fuel efficient vehicles, as well as continuing efforts in the conservation and carpooling areas in 1979, as in 1978. This results in a figure of 13.54 x 1.0219 = 13.84 MPG.

Alternate 3

The third alternative entailed estimating the potential acceleration in the growth rate from 1977 to 1978 and 1978 to 1979 in MPG due to the previously mentioned EPCA. This resulted in an estimated MPG growth of +3.08%, resulting in an MPG figure of 13.54 x 1.0308 = 13.96 MPG.

The range of values in the MPG figures therefore varied from 13.70 to 13.96 MPG. These figures were then used to estimate the resulting range of permissible AVMT for 1979. The following relationship was used.

AVMT = MPG x gallons of motor fuel consumed.

Alternate 1

$x = 13.70 \times 2{,}538{,}758{,}000$

$x = 34.781$ billion AVMT

Alternate 2

$x = 13.84 \times 2{,}538{,}758{,}000$

$x = 35.136$ billion AVMT

Alternate 3

$x = 13.96 \times 2{,}538{,}758{,}000$

$x = 35.441$ billion AVMT

The 1979 AVMT estimate developed using this approach resulted in the range of 34.781 billion AVMT to 35.441 billion AVMT.

IV - Results and Conclusion

The preliminary figure of 35,178 billion AVMT for 1979 was developed by combining the average annual daily traffic (AADT) figures derived from the Traffic Counting Program with the Road Inventory Program's data file. This allowed the compiling of a mileage data file with AADT's on each link of the Federal-Aid Interstate and Primary Systems. AADT estimates were then developed for the remaining functional classifications based upon both current and previous data.

This preliminary travel figure was then evaluated by the Bureau's Motor Vehicle Statistics Section for consistency with motor fuel consumption, vehicle registration records, and the increasing efficiency of the motor vehicle fleet. This analysis determined that the range for 1979 AVMT should be between 34.781 and 35.441 billion AVMT.

The preliminary figure of 35.178 billion AVMT was within the range described above and became the official AVMT figure for 1979 in Massachusetts.

## GLOSSARY AND ACRONYMS

| | |
|---|---|
| AADT | annual average daily traffic |
| arterial (major, minor) | See functional classification |
| ATR | automatic traffic recorder |
| annual vehicle miles of travel (AVMT) | Number of vehicle miles of travel driven on the entire road and street network over the course of an entire year. |
| BTP&D | Bureau of Transportation Planning and Development of the Massachusetts Department of Public Works |
| collector | See functional classification |
| DVMT | daily vehicle miles of travel |
| FA | Federal-aid system |
| FHWA | Federal Highway Administration |
| FC (Functional Classification) | functional classification is the process by which streets and highways are grouped into classes, or systems according to the character of service they are intended to provide. Functional classification defines the nature of channelization by defining the part that any particular road or street should play in serving the flow of trips through a highway network. The systems are arterial highways, collectors and local roads. |
| link | The transportation system element connecting two adjacent nodes. |
| MDPW ("The Department") | Massachusetts Department of Public Works |
| MPG | miles per gallon |
| NHIPS | National Highway Inventory and Performance Study |
| RMV | Massachusetts Registry of Motor Vehicles |
| vehicle miles of travel | Number of vehicle miles of travel driven on a certain road or street network over a specified period of time. |

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